UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY

FOREST INSECT INVESTIGATIONS

RELATION OF INSECTIVOROUS BIRDS TO THE MORTALITY of the MOUNTAIN PINE BEETLE DURING THE FLIGHT PERIOD

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March 25, 1930

U. S. GOVERNMENT PRINTING OFFICE: 1929 I 76123

RELATION OF INSECTIVOROUS BIRDS TO THE MORTALITY OF THE MOUNTAIN PINE BEETLE DURING THE FLIGHT PERIOD.

Introduction

The developmental period of the life history of the Mountain pine beetle, (Dendroctonus monticolae) is very well known, but there still remains much to be learned concerning the flight habits and the mortality which occurs during the interval between their emergence from the trees and the new attacks. Insectivorous birds have been considered beneficial in destroying a number of the adult beetles during their flight period. In order to secure more definite information on this subject a study of the relation of insectivorous birds to the mortality of the mountain pine beetle during its flight period was included in the investigative progrem of the Coeur d'Alene Forest Insect Field Station for the season of 1928. In connection with this study the writer collected a small series of insectivorous birds during part of the Mountain pine beetle flight period in August 1928 on the Bitterroot National Forest, 12 miles east of Sula, Montana. This study was made possible through the cooperation of the Fish and Game Department of the State of Montana in issuing a special collecting permit to the Bureau of Entomology, and the Bureau of Biological Survey, Washington, D. C. for the determinations of the food contents of the stomachs and gullets of the birds collected. The results of the study were given by the writer in a brief report "Relation of Insectivorous Birds to the Mortality of the Mountain Pine Beetle, during the Flight Period," April 24, 1929.

The findings of the initial study were considered of enough importance to continue the experiment again in 1929.

A larger series of insectivorous birds were collected by the writer in the heavily mountain pine beetle infested area, in the vicinity of Yale, Montana, during July and August of 1929. The study was again made possible through the cooperation of the Fish and Game Department of the State of Montana and the Bureau of Biological Survey, Washington, D. C.

Scope.

The results of the stomach analyses for 1928 showed that of the five different species of insectivorous birds collected the nighthawks had proven the most beneficial in destroying large numbers of D. Monticolae adults during the flight period. An additional number of nighthawks were secured during the 1929 season, and over a larger land area and period of time, hoping to secure more data on the flight habits of the mountain pine beetle.

A total of 26 birds were collected during the interval of July 30 to August 5, inclusive, consisting of 14 nighthawks, 1 red-shafted flicker, 3 alpine three-toed woodpeckers, 5 rocky mountain hairy woodpeckers, and 3 Lewis woodpeckers. A complete analyses of the stomach and gullet contents as determined by the Bureau of Biological Survey brought out the fact that the food of the 26 birds contained the following:

	Animal Matter	Vegetable Matter
14 Nighthawks	100%	——
1 Rocky Mt. Woodpecker	92%	8%
1 Rocky Mt. Woodpecker	95%	5%
1 Rocky Mt. Woodpecker	100%	——
1 Rocky Mt. Woodpecker	88%	12%
1 Rocky Mt. Woodpecker	100%	——
1 Lewis Woodpecker	26%	74%
1 Lewis Woodpecker	14%	86%
1 Lewis Woodpecker	20%	80%
3 Alpine Three-Toed Pkr.	100%	——
1 Red Shafted Flicker	100%	——

The animal matter consisted entirely of insects and a list of the orders represented, with number of species and insects is shown in the following list.

List of insects consumed by insectivorous birds, in the vicinity of Bule, Montana, arranged according to orders

Class	Order	No. of Species	No. of Insects	Remarks
Diplods		1	2	Millipeds
Arachnida	Pseudoscor-pionida	2	73	Habit of clinging to the legs and bodies of beetles brought them into contact with the Nighthawks.
	Araneida	2	2	Spiders
	Acarida	1	Many	Mites
Hexapoda	Orthoptera	4	54	
	Isoptera	1	2	
	Ephemerida	1	365	May Flies
	Neuroptera	1	198	Chrysopidae
	Plecoptera	1	98	
	Trichoptera	1	439	Caddis Flies
	Homoptera	16	140	
	Hemiptera	18	1214	1053 Miridae (Platylygus grandis)
	Coleoptera	66	839	D. monticolae (adults 364)
	Diptera	16	214	
	Lepidoptera	3	1694	Many fragments
	Hymenoptera	34	1256	Ants-919
Totals		179	5016+	The exact number not known owing to difficulty in counting partly digested fragments.

This list shows that the numerical importance of the insects consumed is as follows: Hymenoptera with 34 species and 1256 insects. Hemiptera with 18 species and 1214 insects. and Coleoptera with 66 species and 839 insects. 364 of which were adult D. monticolae beetles.

The proportion in per cent of the various insects taken by all the birds is divided as follows.

1929		1928	
Viridae P. grandis	21.0 Per cent	Ants	64.9 Per cent
Ants	18.3 " "	May flies	12.1 " "
D. Monticolae	7.3 " "	D. monticolae	8.37 " "
All other insects	53.4 " "	All other insects	14.63 " "
	100 .0 " "		100.00 " "

The proportion in per cent of the various insects taken by the nighthawks is:

1929 - - 14 Nighthawks		1928 - - Nighthawks	
Viridae P. grandis	24.2 Per cent	Ants	50.0 Per cent
Ants	11.8 " "	May flies	12.1 " "
D. Monticolae	1.4 " "	D. Monticolae	8.22 " "
May flies	7.2 " "	All other insects	12.0 " "
All other insects	30.0 " "		82.32
	74.6		

74.6 Per cent of total insects

82.32 Per cent of total insects

List of birds by species, with date of collection and volume in per cent of D. monticolae adults taken as food:

Date: 1929	Hour collected	Specimen no:	Species	Stage	No. of D. P. as food	Volume of food
7/20	8.25 PM	1	Nighthawk	Ad	----	----
7/21	8/45 PM	2	Nighthawk	Ad	----	----
7/22	10.50 AM	3	Rocky Mt. Hairy Woodpecker	Yng	----	----
7/22	7.30 PM	4	Lewis Woodpecker	Yng	--	----
7/22	7.45 PM	5	Lewis Woodpecker	Yng	----	----
7/24	5.30 PM	6	Lewis Woodpecker	Yng	----	----
7/25	8.20PM	7	Nighthawk	ad	----	----
7/25	8.25 "	8	Nighthawk	ad	6	1.5%
7/25	8.30"	9	Nighthawk	yng	1	1.0%
7/25	8.30 "	10	Nighthawk	yng	----	----
7/27	9.00AM	11	Alpine 3-toed Woodpecker	yng	27	22.0%
7/27	9.15 AM	12	Rocky Mt. Hairy Woodpecker	yng	----	----
7/27	10.20 "	13	" " "	"	1	Trace
7/27	11.10"	14	" " "	"	----	----
7/27	1.15 PM	15	" " "	"	69	80.0%
7/27	8.15 PM	16	Nighthawk	ad	1	Trace
7/27	8.25 PM	17	"	ad	----	----
7/27	8.45 PM	18	"	ad	5	1.0%
8/2	8.10 PM	19	"	ad	----	----
8/2	8.30 PM	20	"	ad	32	8.0%
8/3	12.30 PM	21	Alpine 3-toed Woodpecker	yng	114	100.0%
8/3	12.30	22	Alpine 3-toed Woodpecker	yng	83	100.0%
8/3	4.30PM	23	Red Shafted Flicker	yng	----	----
8/3	8.15PM	24	Nighthawk	ad	----	----
8/3	8.25 "	25	Nighthawk	ad	1	1.5%
8/5	8. 20"	26	"	ad	24	4. 0%
Totals		26			364	

This list shows that of the 26 birds collected in 1929, 12 of them had consumed D. monticolae adults in varying numbers from 1 to 11⅓, and in per cent of food volume from a few fragments to 100% .

In 1928, fifteen of the 18 birds collected had consumed D. monticolae adults as food in varying numbers from 1 to 289 and in per cent of food volume from a trace to 20 per cent. The ten nighthawks collected in 1928 had taken mountain pine beetle adults in flight to the number of [illegible] which was 98 per cent of the total number taken by all the various birds collected. Of the 18 nighthawks collected in 1929 only seven had taken D. monticolae adults in flight. The total number as determined by the stomach analysis being 70 or 19.2 per cent of the total number taken by all of the various birds collected.

The largest number of mountain pine beetle adults found in birds collected in 1929 were in the stomachs of the three alpine 3-toed woodpeckers, and one of the rocky mountain hairy woodpeckers. The three alpine woodpeckers had taken a total of 224 or 61.5 per cent of the total number and the one rocky mountain woodpecker 69 or 19 per cent of the total number.

In making life history studies of the mountain pine beetle in the vicinity of Sula, Montana, it has been found that in many instances female parent adults, while extending their egg galleries, have been taken by woodpeckers. A small hole is found pecked through the bark at the upper of the egg gallery, through these openings the parent beetles are extracted, probably being located by sound during activity of gallery construction.

It is a well known fact that woodpeckers destroy a large number of larvae and pupae of the mountain pine beetle during the late fall and winter months. The data secured from the stomach analysis of the 1929 collection of alpine three-toed and rocky mountain woodpeckers shows that these species as found in the bark beetle infested regions are also very beneficial in destroying large numbers of adult D. monticolae during the period of flight and attack, scouring them from the outer bark surface, and in removing many during egg gallery construction

No insects of economic importance were found in the stomachs of the three Lewis woodpeckers and one red shafted flicker collected in 1929

In an endeavor to give some reasons for the decrease of mountain pine beetle adults shown by the 1929 stomach analyses of the 14 nighthawks, as compared with the 10 collected in 1928, the following suggestions are offered.

In working out the life history of the mountain pine beetle in lodgepole pine, it has been found that the brood development is governed to a great extent by weather conditions which vary considerably from year to year. These variable conditions have a tendency to influence the start of the mountain pine beetle emergence period in a corresponding manner; this variance period may have a range of from 10 to 14 days. This was found to be the case with the seasons of 1928 and 1929. In 1928 the first recorded new attacks by D. monticolae were on July 16, while in 1929 newly attacked trees were found on July 5. This emergence variation would accordingly effect the stomach analyses of insectivorous birds collected on various dates.

The shifting of the mountain pine beetle infestation would also have a noticeable effect on the number of adult beetles secured by nighthawks that inhabit a preferred area year after year. In areas where large numbers of host trees are available for attack the bulk of the beetles apparently do not fly far in search of new hosts, but as the infestation develops into a severe epidemic and lasts over a period of years, the adult beetles shift about in their flight and at times fly long distances, probably governed by air currents and the proximity of new host areas.

Of the 14 nighthawks collected in 1929, 11 were secured on the same area as the 10 specimens in 1928 which had consumed 737 mountain pine beetle adults. The 11 taken in 1929 had only consumed 69 D. monticolae adults, though the early emergence and peak of the flight period was in their favor; but as the intensity of the epidemic had shifted from 6 to 10 miles west from the area of collection it is believed that the scarcity

of mountain pine beetle adults in flight was the cause of the small number recorded in the stomach analyses for 1929.

The largest number of mountain pine beetle adults was secured by the alpine three-toed and Rocky Mountain hairy woodpeckers. These specimens were collected six miles west of the locality from which the nighthawks were secured, and were in a much heavier infested area. As the woodpeckers depend almost exclusively on insects bred in the bark and wood of trees they have a tendency to follow the spread of these infestations. Nighthawks taking all kinds of insects as food restrict their feeding area to a certain limit, coinciding with their breeding grounds, which in the case of the East Fork of the Bitterroot River are not extensive owing to the small unforested area, particularly low gravelly flats which are their preferred habitat. An effort was made to secure a few specimens of nighthawks from the area where the alpine 3-toed woodpeckers were collected, but none were seen. The locality probably not being a feeding zone. Other noticeable changes in the nighthawks' diet from 1925 to 1929 was the decrease in number of mayflies and ants and the large number of Miridae (Platylygus grandis) taken in 1929. The appearance and disappearance of these various insects is no doubt governed to a great extent also by weather conditions

Conclusion

The stomach and gullet analyses of a small series of insectivorous birds collected in 1928, on an area of 5 square miles and over a period of 5 days in the vicinity of Sula, Montana, showed that insectivorous birds, particularily Nighthawks, destroyed many D. monticolae adults during their flight period.

A similar collection made in 1929 on an area of 16 square miles and over a period of 17 days, in the vicinity of Sula, Montana during the flight period of D. monticolae gave additional evidence of the value of insectivorous birds in destroying adults of the mountain pine beetle. The results of the 1929 collection showed that the Alpine 3-toed and Rocky Mountain hairy woodpeckers had taken the largest number of mountain pine beetle adults as food, the nighthawks being next in importance.

The woodpeckers being much more abundant than the nighthawks and continuing their activities throughout both the flight and developmental periods of the mountain pine beetle, are undoubtedly the most beneficial birds in the region.

Respectfully Submitted

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